Earth's Atmosphere and Weather

6-4 The student will demonstrate an understanding of the relationship between Earth's atmospheric properties and processes and its weather and climate. (Earth Science)

6-4.8 Explain how convection affects weather patterns and climate.
Taxonomy level: 2.7-B Understand Conceptual Knowledge

Previous/Future knowledge: This indicator contains new conceptual material. It can be reinforced with concepts in standard 6-5.6 where heat energy transfer is illustrated. Students will relate the movement by convection to plate tectonics in 8th grade (8-3.6).

It is essential for students to know that because warm air near Earth's surface rises and then cools as it goes up, a *convection current* is set up in the atmosphere. There are three atmospheric convection areas in the northern hemisphere and three in the southern hemisphere.

- the *tropical region* begins at the equator and extends to the about 30 degrees north latitude;
- the *temperate region* extends from there to about 60 degrees north latitude, and
- the *polar region* extends from there to the north pole, 90 degrees north latitude.

NOTE TO TEACHER: Students will focus their understanding on the northern hemisphere convection regions, or cells:

Convection happens on a global scale in the atmosphere and causes global winds. These winds then move weather systems and surface ocean currents in particular directions.

- Due to the spinning of Earth, the weather systems in these regions move in certain directions because the *global wind belts* are set up (6-4.9).
- On a smaller scale, convection currents near bodies of water can cause local winds known as *land and sea breezes*.
- The *surface currents* of Earth's oceans that circulate warm and cold ocean waters in convection patterns also influence the weather and climates of the landmasses nearby.
- The warm Gulf Stream current water influences the eastern Atlantic shoreline of the United States, while the cold California current influences its western Pacific shoreline.

Because of the unequal heating of Earth, *climate zones* (tropical, temperate, and polar) occur.

- Since temperature is a major factor in climate zones, climate is related
  - to the convection regions at various latitudes,
  - to temperature differences between the equator and the poles, and also
  - to warm and cold surface ocean currents.

It is not essential for students to locate, classify, or identify the characteristics of various global climate regions. This indicator is not a complete study on the conditions related to climate. Climate is only related as an effect of global convection.

Assessment Guidelines:
The objective of this indicator is to *explain* how convection affects weather patterns and climate; therefore, the primary focus of assessment should be to construct a cause-and-effect model of convection's impact on Earth's convection regions, global winds, ocean surface currents, and climate. However, appropriate assessments should also require students to *interpret* diagrams

related to convection; *compare* convection regions to the global wind belts; or *identify* the convection regions or ocean currents that influence climate along the coasts of the United States.